

RHYNCHODEMUS HOWESI: a new European Species of Terrestrial Planarian Worm. By R. F. SCHARFF, Ph.D., B.Sc., Keeper Nat. Hist. Coll., National Museum, Dublin.*

[Read 15th February, 1900.]

(PLATE 6.)

I FOUND this worm during the autumn of 1899 in the Pyrenees, close to the village of Baux Chaudes. This village, famed for its medicinal waters, lies at a height of about 2000 feet above sea-level, in a most picturesque valley surrounded by dense forests. The worm was discovered under a stone coiled round the shell of a *Helix nemoralis*. The snail had apparently been overcome by the worm previous to being devoured, as it had retired far up into its shell and exhibited little sign of life. When I released the snail, the worm slowly crawled away, leaving an abundant track of mucus like that of a slug. I had hoped to be able to find out something more about it after a closer examination, but owing to the very dark pigment in the skin, no eyes were visible, nor were any openings to be seen on the underside. However, I had no doubt of the true nature of the worm, the general shape of the body indicating a terrestrial planarian. I believed that I had before me a gigantic member of the genus *Rhynchodemus*, and this surmise has now proved to be correct.

The width of the worm was 5 millim., and the length no less than 130 millim. (about 5 inches)—just twice as long as the largest *Rhynchodemus* hitherto known to science. The colour of the upper side was of a uniform greyish black (Pl. 6. fig. 1). The under side (Pl. 6. fig. 2) is made up of the median sole, aptly called "Kriechleiste" by Prof. von Graff, since it is a somewhat raised plate on which the animal creeps. It occupies one third of the ventral side of the body (Pl. 6. fig. 2, s) and is coloured light grey; while on each side we find a dark grey stripe bordered by a brownish-grey marginal one. The latter, which will be referred to again later on, is von Graff's "Drüsenkante" or glandular ridge. The dorsal and ventral surfaces are sharply distinct in contour, the former being convexly rounded, the latter almost flat. The anterior end of the body is not directly concerned with the creeping movements, and the sole does not extend

* Communicated by Prof. G. B. Howes, Sec. L.S.

into it. It is finely pointed and somewhat cylindrical, and is the seat of the principal sensory organs of the body. As the animal moves about, it is kept off the ground and acts as a tactile organ much like the tentacles of a snail. In some of the Planarian worms, such as *Placocephalus kewensis* (*Bipalium kewense*), which has been taken in a few English and Irish greenhouses, this portion of the body assumes a characteristic cheese-cutter shape. The posterior end of the body of our worm is but slightly attenuated, and the sole is continued to the extreme tip.

These were all the observations that I could make during the life of the single specimen in my possession*. I decided therefore to kill it without further delay, and placed it in a 4-per-cent. solution of commercial formalin. The immediate effect was a very considerable shrinkage of the specimen, which became reduced to a length of 75 millim. and a width of $4\frac{1}{2}$ millim.† One advantage this treatment had on the worm was to reveal two openings on the underside. From the first, situated 40 millim. from the anterior end, a triangular body, viz., the pharynx (Pl. 6. fig. 2, *ph.*), had been partially forced out by the contraction. This larger opening is therefore the mouth, and the much more minute one (*g*), 13 millim. behind it, the genital pore.

Being unable to perceive any trace of eyes or even of a sensory groove at the anterior end of the body, I felt it would have been impossible to determine the specimen with any degree of certainty without cutting sections. In this dilemma my friend Prof. Howes offered me help. He kindly commissioned one of his students, Mr. H. H. Swinnerton, to cut me a number of microscopic sections, and to their generous assistance I owe the pleasure of being able to describe this interesting specimen, and add another species to the known European Land-planarians. The name *Rhynchodemus Howesi* is therefore appropriate.

The recent publication of Prof. von Graff's magnificent monograph on the Land-planarians (2), has rendered the identification of my specimen a comparatively easy task. To give a complete account of its anatomy would be quite impossible, as the single

* It has now been deposited in the Dublin Museum.

† Unfortunately, the vessel containing my specimen broke on the journey from the Pyrenees to Bordeaux, but the officials of the Museum in the latter town most liberally offered me a new jar with alcohol. Owing to these adverse circumstances the preservation of the worm is not altogether satisfactory.

specimen could not be entirely sacrificed to the microtome. I content myself therefore with giving a short sketch of some of the more important anatomical features which could be gathered from a careful examination of the sections. The head and a portion of the body containing the pharynx were cut into transverse sections, whilst a small part bearing the genital pore was utilized for longitudinal ones. From these the following observations were noted:—

One of the most striking objects in the series of sections near the anterior end of the body is the pair of eyes. If we examine such a section more closely (Pl. 6. fig. 3), we notice externally the *epidermis* (*ep.*). Some previous writers, especially Prof. S. Moseley (4) and Dendy (1), have referred to the great difficulty in obtaining a clear idea of the structure of this layer from ordinary cross sections. My single specimen, as already stated, had not been fixed in a satisfactory manner for histological purposes. But whatever method is employed for fixing, the chief difficulty in recognizing the structure of the epithelium lies in the fact that the greater part of it is filled with rod-like bodies, while numerous glands open between the cells to carry their secretions to the exterior. The epithelium consists of a single layer of cells which, in this part of the body, are about equally high on the dorsal and ventral surface. The sole (*s*)—von Graff's "Kriechleiste"—possesses a ciliated epithelium, but cilia appear to be confined to this part of the under surface. The most noteworthy features in connection with this sole are the sensory grooves (*sg.*), which I failed to make out from a macroscopic examination of the worm. They are probably united in front in the form of a horseshoe, the two branches being continued backward for a little distance beyond the eyes on each side of the sole. These sensory grooves have been demonstrated in the great majority of Land-planarians by Prof. von Graff. As a rule there are also sensory pits in connection with the grooves, but according to the same author (2. p. 42) these are absent in *Rhynchodemus bilineatus*, *Rh. Scharffi*, *Rh. nematoides*, and *Rh. ochroleucus*. No trace of such pits could be seen in the cross-sections of *Rh. Howesi*, so that it agrees in this respect with some of the other species of the genus.

Almost all previous writers on the Land-planarians have referred to the peculiar rod-like "*Rhabdites*," which have been compared to the stinging-organs of Cœlenterates, but whose

precise function is still unknown. It has been suggested that they serve for the capture of the prey; and this explanation is supported by the observations of Dendy (1) and Woodworth (6). Prof. von Graff distinguishes three varieties of rod-like bodies (2. p. 55), viz.:—"Rhabditen, Rhamniten, and Chondrocysten," but observes that there is no real difference in kind—that the Rhamnites and Chondrocysts in fact only indicate the extremes in both directions of the true Rhabdites. The Rhabdites are short and stout, the Rhamnites longer and much more slender, while the Chondrocysts are oval or club-shaped masses. I could clearly trace the latter form in many of the sections and also the Rhabdites, but failed to perceive any rods that could be brought under the second denomination.

As regards the glands which lie in the connective-tissue and open on the surface of the epidermis, only one kind is noticeable in the section referred to. They convey mucus to the skin, and become deeply stained by hæmatoxylin and less so by borax-carmin, which were the reagents used. Portions of mucus in the ducts between the epithelial cells are frequently seen, and lead one to mistake them for Rhabdites, but the latter are pointed at each end, and by that means can be distinguished. In the more posterior sections very large glands are noticed near the margins of the lower body-surface. These—the "Kantendrüsen" of Graff—are confined to that part of the body, and will be referred to later on.

The *muscular* and *nervous systems* are dealt with so exhaustively by Prof. von Graff, Prof. Dendy, and others, and there appears to be so little difference in the various species, that a detailed description of the necessarily incomplete observations I have been able to make, appears undesirable. There are a deep and a superficial muscular system, while the nervous system consists of two longitudinal cords, with an anterior bilobed ganglionic mass or brain. The section (Pl. 6. fig. 3) being slightly oblique, only one half of the brain (*b*) is visible. Close to it on the dorsal portion of the head lie the *eyes*, one on each side. One of them (*e*) is represented in the section. Prof. von Graff has drawn attention to the fact that two very distinct types of eyes occur among the Land-planarians. These two types he called "Invertirte Kolbenaugen" and "Retina-Augen." In the first type, the retina is placed in front of the eye, and the sensitive cells are turned away from the source of light, hence the term

“inverted club-shaped eyes.” The eyes of *Rh. Howesi* belong to the other or “retina” type. It consists simply of a cup-shaped organ internally coated with small pigment-cells and surrounded by a retina, so that the latter is placed facing the light. The open part of the cup is covered by a non-pigmented layer of cells—a kind of cornea. The latter has a thickness of 0·012 millim.; while the whole eye is 0·16 millim. long, and at its widest part 0·108 millim. broad. The interior of the eye is partly filled with a peculiar cellular substance, whose true nature could not be ascertained from any of the sections available. I had no means of comparing the sections with longitudinal ones, and must presume that this structure is similar to that figured by Prof. von Graff (2. pl. 50. fig. 1). He explains (p. 144) that it is composed of a bundle of elongated columns, one end of which converges towards the centre of the eye, whilst the others are connected with the retina-cells by means of fine prolongations which pass outward between the pigment-cells.

Connective-tissue (Pl. 6. fig. 3, *c.t.*) binds together the various organs and structures lying within the epidermis and maintains them in position. It consists of a mass of fibres containing nuclei, and bearing also the generally small pigment granules which produce the black colour of the skin. The *digestive organs* do not extend to the most anterior part of the body, and are therefore not visible in the section (Pl. 6. fig. 3), but a little farther back we find a considerable part of the transverse sections occupied by the alimentary canal (text-fig. 1, *al*).

All Land-planarians and also the marine and freshwater Tricladæ agree in the possession of an alimentary canal consisting of three main branches and a muscular pharynx. One of the main branches runs anteriorly, the two others (text-fig. 1, *r.al.*, *l.al.*) occupy the posterior portion of the body, and they all join in a common opening in front of the pharyngeal sac.

I have already mentioned that the pharynx had become protruded through the mouth during the violent contractions when the worm was preserved. The mouth, as stated, is situated 40 millim. behind the anterior end of the body, and is indicated by a minute transverse slit scarcely visible in the living animal. The large pharynx, as seen in text-fig. 1 (*ph*), is somewhat cylindrical, and conically pointed at the free end. The transverse section figured is close to the external pharyngeal opening, and shows peculiar folding of the pharyngeal epithelium. Cilia were

noticed only on the conical end portion of the pharynx. All the three branches of the alimentary canal give off lateral diverticula. None of them appear to be ciliated. There are a few other points in the section referred to (*cf.* text-figs.) which deserve to

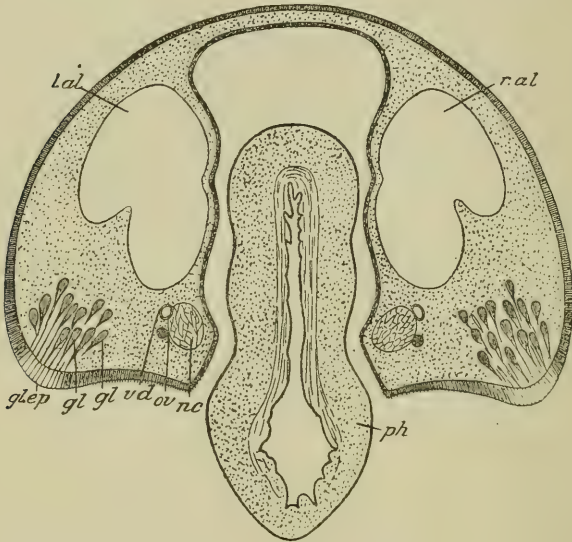


Fig. 1.—*Rhynchodemus Howesi*. Transverse section through mouth (somewhat diagrammatic). $\times 70$.

gl.ep, glandular epithelium; *gl*, glands; *v.d.*, vas deferens; *ov*, oviduct; *n.c.*, nerve-cord; *ph*, pharynx; *r.al*, right branch of alimentary canal; *l.al*, left branch of alimentary canal.

be mentioned. I have already briefly alluded to the glands which are so very abundant in the section near the anterior end. But farther back, where the underside is divided into three distinct areas, a number of large glands are seen to open on the surface towards the sides of the body. These are roughly indicated on the transverse section (text-fig. 1, *gl*). They are what von Graff described as "Kantendrüsen," and are strictly localized to that particular portion of the body. They are deeply stained by hæmatoxylin like the other glands, and their ducts have deformed the epithelial cells between which the glands conduct their secretions to the exterior.

In one important respect these epithelial cells differ from all those described by von Graff, namely, in size. He remarks

(2. p. 43) that the height of the "Drüsenkanten-epithel" is less than that of the dorsal epithelium, while I find (*gl.ep*) that it greatly exceeds that in height. Another interesting fact worth noting is that *Rh. Howesi* is the only member of the genus *Rhynchodemus* in which these peculiar marginal glands occur. The cilia so well seen towards the middle of the underside do not extend to this glandular area.

All Land-planarians are hermaphrodite, a pair of ovaries being situated near the anterior end of the body. These give rise to an oviduct on each side of the body (*cf.* text-figs., *ov.*), which generally unite before opening posteriorly into the genital atrium. The testes lie farther back than the ovaries, and the two vasa deferentia (*v.d.*), carrying the spermatozoa, open as a rule separately into the vesicula seminalis (*v.s.*), from which a duct leads into the genital atrium. The genital opening is always situated behind the mouth. In *R. Howesi* it is only very faintly indicated by a minute white spot (Pl. 6. fig. 2, *g*) on the underside of the body, 13 millim. behind the oral aperture.

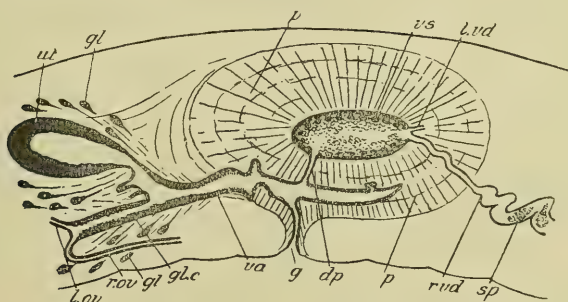


Fig. 2.—*Rhynchodemus Howesi*.—Longitudinal section through reproductive organs (somewhat diagrammatic). $\times 50$.

ut, uterus; *lov*, left oviduct; *rov*, right oviduct; *va*, vagina; *gl*, glands; *p*, penis, *v.s.*, vesicula seminalis; *g*, genital pore; *glc*, glandular canal; *sp*, spermatozoa; *dp*, duct from vesicula seminalis; *rvd*, right vas deferens; *lvd*, left vas deferens.

Instead of giving an accurate drawing of a longitudinal section of the reproductive organs, it seemed to me preferable to show the disposition of the various parts in *Rh. Howesi* by means of a somewhat diagrammatic sketch (text-fig. 2). The reproductive organs in this species agree in the main points with those of *R. terrestris* and *R. Scharffi*, but they are more nearly related

to those of the former. The oviducts (text-fig. 1, *ov*) lie close to the nerve-cords (*n.c.*), one on each side, in which position they run from the anterior ovaries backward beyond the genital pore and open independently into a wide glandular canal (text-fig. 2, *gl.c.*), as in *Rh. terrestris*. This canal is characterized by the possession of very elongated and ciliated epithelial cells between which open numerous glands (*gl*)—von Graff's shell-glands. During their course the oviducts receive the contents of many yolk-glands. Every now and then, in transverse sections, short cylindrical ducts conveying food-material for the eggs are noticed opening into the oviducts. The latter, it may be mentioned, are ciliated. The glandular canal (*gl.c.*) opens anteriorly into another, the vagina (*va*), and it is joined there by a duct from a large glandular organ—the uterus (*ut*).

The numerous testes are arranged in a row on each side of the body close to the upper side of the nerve-cords. Two vasa deferentia (text-fig. 2, *v.d.*) convey the spermatozoa towards the muscular mass of the penis (*p*). But before they reach it they become dilated to form thin-walled convoluted ducts, which in the specimen examined were filled with masses of agglutinated spermatozoa (*sp*). Each of the vasa deferentia opens independently into a sac—the vesicula seminalis (*v.s.*)—which is surrounded by an enormous muscular mass constituting the penis (*p*). A narrow duct (*d.p.*) leads from the vesicula seminalis to the genital atrium, into which also opens the vagina. The atrium finally communicates with the exterior (*g*) by a short duct. The vesicula seminalis (*v.s.*), under a low power of the microscope, appears to be coated internally with a thick glandular epithelium projecting far into the lumen of the organ. But a high power reveals the fact that the epithelium is thrown into short folds which are closely invested by a thick granular mass. Whether the latter is secreted by the epithelium or by glands lying on the exterior of the muscular penis, I was unable to ascertain.

In the closely allied *Rh. Scharffi* (2. fig. 53, p. 203), the penis lies freely in the surrounding tissue, and is probably eversible to a considerable extent, while in that of the present species the movements would seem to be much more limited.

This concludes my observations on the general structure of *Rh. Howesi*; and it still remains for me to make a few remarks

on its systematic position and relationship. The 348 species of Land-planarians are now divided into five great families, viz. :—

- Limacopsidæ.
- Geoplanidæ.
- Bipaliidæ.
- Cotyloplanidæ.
- Rhynchodemidæ.

Of which the latter is defined by Prof. von Graff as possessing two eyes near the anterior end of body, whilst tentacles, sucking-discs, and head-plates are absent. There can be no doubt, therefore, from the description given above, that the new Pyrenean species belongs to that family. The latter includes the seven genera *Rhynchodemus*, *Microplana*, *Amblyplana*, *Nematodemus*, *Platydemus*, *Dolichoplana*, and *Othelosoma*. The genera *Microplana* and *Amblyplana* are devoid of sensory grooves; and *Nematodemus* has no sole, whilst both sensory grooves and a sole are present in the species described. The genera *Platydemus* and *Dolichoplana* have sensory pits which are absent in our species; and finally *Othelosoma* is distinguished from all other members of the family by the possession of a peculiarly folded and attenuated head-region.

In fact the new European land-planarian undoubtedly belongs to the genus *Rhynchodemus*, and its nearest relation appears to be *Rh. terrestris*. It differs, however, from the latter in being more than 12 times as long, in the possession of rhabdites, of a marginal glandular area on the underside of the body, and in many minor structural points in the reproductive organs.

As regards the geographical distribution of the family Rhynchodemidæ, it is the only cosmopolitan one, and two of its genera, viz. *Rhynchodemus* and *Microplana*, have been found in Europe. The last genus in fact, with its single species *M. humicola* (first described by Prof. Vejdovsky), is confined to our Continent. Thirty-four species of *Rhynchodemus* are known to science, of which five, viz., *Rh. terrestris*, *Rh. bilineatus*, *Rh. pyrenaicus*, *Rh. albicollis*, and *Rh. Scharffi*, occur in Europe. To these must now be added *Rh. Howesi*. Some of them are apparently very local forms, *Rh. bilineatus* and *Rh. albicollis* having only been found in Germany, *Rh. pyrenaicus* and *Rh. Howesi* in the Pyrenees, and *Rh. Scharffi* in Ireland; but *Rh. terrestris* has a much wider range. It is known from Denmark, England, Ireland, France, Germany, Austria, and the Balearic Islands,

whilst I took it myself some years ago on the Brünig Pass, in Switzerland. Though some of the European species have been discovered under somewhat suspicious circumstances, which render artificial importation probable, I quite agree with Prof. von Graff in the opinion that all the European Rhynchodemidæ are truly indigenous to our Continent.

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DESCRIPTION OF PLATE 6.

- Fig. 1. *Rhynchodemus Howesi*, natural size, dorsal aspect.
2. The same, natural size, ventral aspect.
ph., pharynx; *g.*, genital aperture; *s.*, sole.
 3. The same. Transverse section through anterior region, $\times 435$.
e., eye; *b.*, brain; *ep.*, epidermis; *m.*, longitudinal muscular bundles;
s., sole; *sg.*, sensory groove; *ct.*, connective tissue.
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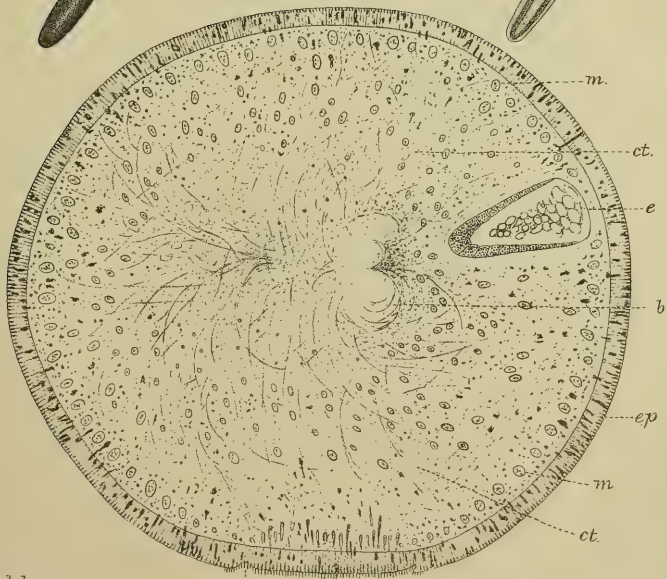
2

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R.F.S. del.
M.P. Parker lith.

Geo. West & Sons imp

RHYNCHODEMUS HOWESI, Scharff.